fetus also has plasma cholinesterase activity present as early as 28 weeks of gestation.

The neurobehavioral assessment scale, for use in evaluating subtle neonatal behavioral alterations induced by anesthetic drugs and the events of labor, was introduced in 1973 by Brazelton and recently modified by Scanlon. This complex system allows far more accurate assessment than by Apgar scoring alone. Neurobehavioral assessment of infants of mothers who received local anesthetic drugs in epidural anesthetics for labor and delivery shows that when lidocaine and mepivacaine were used the infants had poorer muscle tone scores and habituation to pinprick at 2 and 4 hours of age. With the use of bupivacaine or 2-chloroprocaine, scores were equal to or better than those in control infants. It is important to note, however, that all infants were the same by the second day of life. No long-term inferences can be made at this time.

The current recommendations for use of local anesthetic drugs in regional anesthesia for obstetrics are to utilize the minimum amount of drug needed to produce the desired effect and to avoid those agents and techniques that cause measurable changes in the fetus or the neonate. Based on the foregoing considerations, epidural or caudal anesthesia with 2-chloroprocaine or bupivacaine (or both) fulfills these requirements.

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Management of Patients With Increased Intracranial Volume or Pressure

THE CRANIAL VAULT is a semi-closed cavity containing brain, blood and cerebrospinal fluid. These three components do not under normal circumstances completely fill the cavity. Rather, there is room available for expansion. Intracranial pressure (ICP) is normally less than 10 torr. ICP does not rise until increases in cranial contents have completely filled the cranial vault. Then, even slight increases in intracranial volume cause steep increases in ICP. Common causes of an increase in volume are brain tumors, posttraumatic swelling, vasodilatation with increased cerebral blood flow or blockage of cerebrospinal fluid drainage. As ICP rises, a critical lowering of the cerebral perfusion pressure can occur and produce cerebral hypoxia. The mean arterial pressure minus the ICP is the cerebral perfusion pressure. There are compensatory mechanisms that can blunt or reverse elevations in ICP. Compensation can occur through cerebral vasoconstriction, brain shrinkage, reduction of cerebrospinal fluid production and relocation of cerebrospinal fluid in the spinal canal.

The treatment of patients with increased intracranial volume makes use of these compensatory mechanisms and must prevent further increases in volume. Respiratory obstruction or depression must be immediately corrected. Carbon dioxide retention produces cerebral vasodilatation as does hypoxemia if arterial oxygen tension falls below 50 torr. Dilatation from hypoxemia is more serious and troublesome than carbon dioxide retention due to its persistence after the hypoxemia has been corrected. Vasodilatation from carbon dioxide retention increases cerebral blood flow 1 ml per 100 grams of brain tissue per minute for each 1 torr rise in arterial carbon dioxide pressure. However, hyperventilation to produce hypocapnia is immediately beneficial as a reduction of cerebral blood flow of 1 ml per minute is achieved with each 1 torr decrease in carbon dioxide pressure. Additional increases in brain volume can be prevented by fluid restriction and the avoidance of 5 percent dextrose in water solutions. Dextrose in water is rapidly absorbed into brain cells carrying water with it. Stabilization of the blood-brain barrier with large doses of steroids, usually dexamethasone, also inhibits swelling. Brain bulk can be reduced through cerebral dehydration with osmotic and renal diuretics such as mannitol and furosemide. Methods of decreasing cerebrospinal fluid production are less well defined, although steroids may decrease production.

Reduction of cerebrospinal fluid volume should only be done at surgical operation. Spinal taps are to be condemned because danger of herniation of the brain is real and little helpful information is obtained. During surgical operation, the head-up position and avoidance of jugular vein compression enhance venous return. Volatile anesthetic agents cause cerebral vasodilatation proportional to their anesthetic depth and, therefore, should be avoided or administered at very light levels only after hypocapnia has been established and verified. Monitoring of arterial blood gases and

pressure is aided by arterial cannulation and is highly recommended.

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Radial Artery Cannulation

RADIAL ARTERIES are cannulated for blood gas sampling, continuous blood pressure and pulse rate monitoring, pulse wave analysis, cardiac output determinations, phlebotomy, exchange transfusions, angiography and pulse triggering of intra-aortic balloons. Thrombosis may occur in 60 percent of cannulated radial arteries. Even with complete occlusion, collateral circulation from the ulnar artery usually prevents ischemic complications. Assessment of the patency and distribution of ulnar artery collateral flow before radial artery cannulation is mandatory. Collateral flow can be measured by the modified Allen test, finger plethysmography or Doppler flow studies. In three percent of the population, collateral flow is inadequate and radial artery cannulation is contraindicated.

Measurement of wrist circumference is a reliable predictor of the risk of vascular occlusion developing. The smaller the wrist, the smaller the radial artery and the greater the likelihood of subsequent thrombosis. If the wrist circumference is less than 16 cm, the radial artery should be cannulated with small (20-gauge) catheters. The incidence of radial artery thrombosis is also directly related to the size, shape, and composition of the catheter used. In adults, 20-gauge catheters are associated with fewer cases of thrombosis than 18-gauge catheters. Untapered catheters are safer than those with tapered shafts. Teflon catheters have a lower incidence of thrombosis than similar polypropylene catheters. Finally, the occurrence of radial artery thrombosis is directly proportional to the duration of cannulation, so catheters should be removed as soon as they are no longer needed. Intermittent or continuous infusion of dilute heparin solution will prolong the patency of indwelling catheters but will not prevent eventual thrombosis. Concentrated heparin solutions will cause arterial vasoconstriction.

Care must be exercised not to inject air bubbles when flushing the catheter, and the flush solution must be injected in small volumes (less than 3 ml) at slow rates to avoid retrograde embolization of clot material to the carotid artery. Blood removed from the catheter should not be reinjected into the artery, but should either be discarded or placed into the venous system. Catheters should be aspirated for clots periodically and during decannulation. Catheter balloon thrombectomy can also be carried out if necessary.

Ischemic complications requiring thrombectomy occur in 0.2 percent to 0.6 percent of radial artery cannulations. No major vascular complications requiring amputation occurred in one series of 4,000 cannulations. Consideration of the factors discussed makes radial artery cannulation a safe procedure.

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Banked Autologous Blood Transfusion

WITH THE INCREASING SCARCITY of stored banked blood, it is becoming apparent that a large proportion of patients with anticipated transfusion requirements can safely donate their own blood before elective operations.

The prior deposit of a patient's own blood avoids most of the hazards associated with homologous blood transfusions. Other advantages are stimulation of erythropoiesis and conservation of donor reserves. Excessive falls in the hemoglobin level to less than 10 grams per dl can be avoided with judicious iron therapy. Plasma volume is restored 32 to 76 hours after phlebotomy.

One unit of blood can be taken every four to seven days, up to 36 hours before an operation. The blood storage time limit of 21 days can be increased to 35 days by the use of citrate-phosphate-dextrose solution, and storage time is practically unlimited with frozen red blood cells. As identification errors are still possible, a fail-proof identification system is necessary, together with serologic tests and informed consent.

Suitable candidates for autologous transfusion include most elective surgical patients in reasonably good health, although patients with coronary, valvular or congenital cardiac disease have do-